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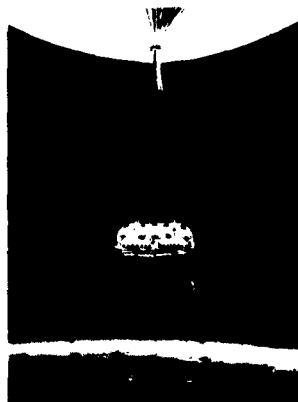
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MINNEAPOLIS 20, MINNESOTA

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REPORT ON LOW LEVEL BALLOON PILOT TRAINING FLIGHTS

Report No. : 1274-R

Submitted To: Chief of Naval Research
Code 461
Department of the Navy
Washington 25, D. C.

Contract: NONR 1460(14)

Submitted By: Winzen Research Inc.

Date: 4 January 1963

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Balloon Specification PA-45-100-DWSC-01	

I. SUMMARY

A series of low level balloon-pilot training flights was conducted for the Office of Naval Research. Winzen Research Inc., under contract to the Office of Naval Research, supplied balloons and associated flight equipment and performed the launch operations.

The flights were conducted in April 1962 from the Imperial Valley in California, with the Naval Air Facility, El Centro, serving as the Operations Base.

A total of five flights were made. The first three flights consisted of "jump balloon" flights and the last two flights were Sky Car flights.

The "jump balloon" flights employed a 23 foot diameter balloon with a volume of 6,570 cubic feet. The pilot was suspended from the balloon, through an extended 24 ¹⁵ foot diameter parachute, in a nylon harness and seat arrangement. Flight control was afforded by a manual valve located in the balloon apex and by sand ballast secured in bags to the pilot's harness. The flights were of short duration and to very low altitudes. All flight activity was carried out within the confines of the Naval Air Facility, El Centro.

The Sky Car flights employed the Winzen Research Inc. two-man and four-man open gondolas, Sky Car I and Sky Car II respectively. The flight with Sky Car I employed a 39 foot diameter balloon with a volume of 27,000 cubic feet. The flight duration was 6 hours and 55 minutes. During the flight several

touch and go landings were made. The flight with Sky Car III employed a 45 foot diameter balloon with a volume of 49,240 cubic feet. The total flight time was 2 hours and 40 minutes. An altitude of 10,000 feet was obtained on this flight.

→ The primary objective of the operation, to qualify free balloon pilots, was not achieved, ^{due to} Unsuitable weather, which limited the number of flights that could be conducted, and adverse trajectories on those flights launched, which limited the flight time, accounted for the primary objective not being accomplished.

II. PROGRAM PLAN

Low Level Training Flights From California, April 1962

A. PURPOSE

The Office of Naval Research will conduct a series of low-level pilot training flights from the vicinity of El Centro Naval Air Station during the month of April 1962. Winzen Research Inc. will furnish equipment and services for this operation.

The Navy personnel will include:

Commander B. B. Levitt, Balloon Pilot
Captain V. G. Benson, Balloon Pilot
Lt. Cdr. Stevenson, Balloon Pilot
Lt. George Lucchina, Balloon Pilot

Additional Navy personnel participating:

Commander J. W. Sparkman
Chief Richard Miles
Mr. Michael Evanick

Winzen Research Inc. personnel will include:

O. C. Winzen
Robert M. Enderson
Paul Peterson
Gerhard Endras

B. EQUIPMENT FURNISHED BY WINZEN RESEARCH INC.

1. Balloons

Three (3) 23 foot diameter "jump balloons" with three open 24 foot diameter parachutes and three harnesses and seats.

Two (2) 39 foot diameter balloons.

Two (2) 45 foot diameter balloons.

One (1) 72 foot diameter balloon.

2. Two (2) 70 foot diameter cargo parachutes.
3. Winzen Research Inc. Sky Car I, completely equipped.
4. Winzen Research Inc. Sky Car II, completely equipped.
5. Three (3) portable VHF Transceivers.
6. Miscellaneous inflation and ground handling equipment as necessary for the launch operations.

C. GOVERNMENT FURNISHED EQUIPMENT AND SERVICES

1. Tracking plane
2. 1-1/2 ton stake truck for gondola recovery
3. Transportation of equipment to Naval Air Station El Centro and return.
4. Personnel vehicle
5. Weather Service
6. Helium and helium trailers, including drivers

D. TENTATIVE PLAN OF OPERATIONS

All personnel involved in the operation will meet at the Administration Building, Naval Air Station, El Centro on the morning of Wednesday 18 April. Winzen Research Inc. personnel arriving by rental car from San Diego. A preliminary meeting will be held to determine the following:

1. Names of participating Navy balloon pilots (not firmly established at this time).

2. Sequence of flights (four flights required under Navy program).
3. Logistics of operation including vehicles and their deployment.
4. Decision on launch site (near Naval Air Station, Brawley Airport, Borrego Springs Airport).
5. Time schedule for subsequent briefings and planning meetings.

It is expected that Navy personnel will be housed either at the Naval Air Station or at a nearby motel with the Winzen Research Inc. crew. A hot line will be maintained to the Naval Air Station, San Diego, from where it is planned Lt. Cdr. Arnold will relay weather information to Commander Sparkman and Mr. Evanick.

At the request of the Navy, flexibility will be maintained with regard to the sequence of flights, the type of flights to be made, the launching site and the Navy flight personnel. For this reason, a sufficient quantity of balloons, the two Sky Cars and the "jump balloon" harnesses will be available.

Ground handling and inflation will proceed in accordance with the Winzen Research Inc. check list.

Tracking will be accomplished by a Navy plane under the command of Commander Sparkman.

In order to maintain communications with Navy furnished vehicles and/or the rental car to the gondola and the tracking plane, Winzen Research will have available two portable VHF units for installation in the ground vehicles. Primary communication will be on Unicom 122.8, the only frequency available in these portable units. Availability of secondary or emergency frequencies will depend on Navy equipment to be furnished.

After the launch, the tracking airplane will be in charge of tracking and will guide the ground vehicles to the landing site. Return of the gondola to the starting point will be accomplished by the 1-1/2 ton Navy truck.

III. FLIGHT DESCRIPTION

A. FLIGHT NUMBERS WRI 901, WRI 902 AND WRI 903.

All three of these flights employed the Winzen Research Inc. "jump balloon" technique. A 23 foot diameter balloon with an inflated volume of 6,570 cubic feet was utilized in conducting these flights. The balloons are equipped with a manual valve. A 24 foot diameter personnel parachute, in an extended condition, is attached to the balloon base fitting and a personnel harness fabricated from nylon webbing is in turn attached to the parachute shrouds. The personnel harness is similar to a standard parachute harness with the added feature of a seat. The harness also has provisions for attaching a limited amount of ballast. The balloon is normally inflated so that a slight negative lift condition exists with respect to the total load. The pilot, by pushing off with his legs, is then able to become airborne. Flight duration and other aspects can be controlled by valving and ballasting. The specification for the "jump balloon", PA-23-150-SCDW-01, is included in the appendix of this report.

The three "jump balloon" flights conducted were made from the Naval Air Facility at El Centro. These flights consisted of numerous short "hops" to maximum altitudes of approximately 100 feet and in no case did a flight leave the area of the landing field. The flights were conducted during a period of approximately four hours, from 0600 to 1000 on 21 April 1962. The flights, with the involved personnel, are listed below.

1. Flight No. 901 - Pilot, Captain V.G. Benson, AMAL

2. Flight No. 902 - Pilot, Lt. George Lucchina, NMC, Pt. Mugu, California

3. Flight No. 903 - Pilot, Mr. Don Lind, NMC, Pt. Mugu, California

B. FLIGHT NO. WRI 904

Flight No. 904 was launched from the Brawley, California Airport at 0542 on 22 April 1962. Sky Car I was used on this flight with Commander B. B. Levitt as the pilot and instructor, Lt. Lucchina as student. Captain V. G. Benson replaced Commander Levitt as pilot during a portion of the flight. The transfer in personnel was accomplished during intermediate landings. Total airborne time was 6 hours and 55 minutes. The terminal landing was made at 1245 near Highway No. 88, approximately midway between El Centro and Yuma, Arizona. A total of 42 touch and go landings were made during the course of the flight.

1. Equipment Description

a. Balloon

The balloon was a 39.34 foot diameter balloon with an inflated volume of 27,000 cubic feet. It was constructed from 2.5 mil balloon quality polyethylene and reinforced with twenty eight 500 pound test fortisan load tapes. The balloon was equipped with a 14 inch diameter manually operated apex valve. Complete specifications for the balloon, PA-39.34-250-NS-01, are included in the Appendix.

b. Sky Car I

Sky Car I consists of a basic circular framework fabricated from aircraft quality steel tubing. The inside diameter of the frame is 4.45 feet, the outside diameter 6.55 feet. A circular styra-foam ring attached to the bottom provides the landing gear arrangement. The framework is enclosed with a fabric cover.

The Sky Car is equipped with two seats and seat belts.

Parachute attachment is provided by six eye-bolts equally spaced on the upper inner ring of the basic frame.

Basic instrumentation and controls are located on panels adjacent to the seats. It consists of the following:

- (1). Aircraft Altimeter
- (2). Aircraft Rate of Climb Indicator
- (3). Eight-day Aircraft Clock
- (4). Ambient Air Temperature Thermometer
- (5). Balloon Flight Termination Switch
- (6). Six Channel Crystal Controlled Daze Radio Transceiver

Power is supplied from four 12 volt aircraft batteries. The batteries are mounted on the floor of the gondola between the inner and outer framework.

c. Parachute and Suspension

A 70 foot diameter parachute was used. The canopy was constructed from 1.1 ounce rip stop material with alternate gores of orange and white. The parachute shrouds terminated

at six risers. The ends of the risers were equipped with snaps to facilitate attachment to the gondola.

The parachute was connected to the balloon by a standard Winzen Research Inc. multi-point nylon line suspension harness. To accommodate this type of suspension harness, an aluminum ring is incorporated into the parachute apex construction. Equally spaced on this ring are twelve parachute type "D" rings. A corresponding number of "D" rings are located on the ring in the balloon base. The harness consists of a length of 3,000 pound test nylon line reeved through a total of 24 snaps, 12 each to match and for attachment to the "D" rings located on the balloon and parachute. The ends of the nylon line are tied together forming a closed circular harness. Six, electrically fired, squib operated line cutters are equally spaced in the harness. Their operation is controlled by the flight termination switch in the gondola. The cutters, when fired, sever the harness in six places and allow the balloon and parachute to separate.

2. Flight Operations

The flight was launched at 0542 PST from the airport at Brawley, California. A standard vertical inflation with let-up was made. Lift was determined directly from a weight indicator rigged into the anchor and lift transfer arrangements. The weight breakdown of the flight is as follows:

<u>Item</u>	<u>Weight (pounds)</u>
Sky Car I	400
2 Pilots with personnel gear	400
Drag rope	45
Batteries	120
Parachute plus suspension	95
Ballast (twenty 25 lb. bags)	500
Food and miscellaneous items	45
Balloon	<u>101</u>
Total Airborne Weight	1,706 pounds

The flight was launched with approximately ten pounds of free lift. The weather was clear with very light ground winds. The pilot was Commander B. B. Levitt and the student Lt. Lucchina. The final landing was made near Highway No. 88 between El Centro and Yuma, Arizona. Total flight time was 6 hours and 55 minutes. Difficulties encountered in recovery were due to the landing in desert sand. As a result of the chain of circumstances involved in making the recovery, the ambulance used as a tracking vehicle was completely disabled by engine failure. Additionally, a caterpillar tractor used in recovery was damaged. All vehicles were supplied the the Naval Air Facility, El Centro, California. The log of Flight No. 904 is as follows:

FLIGHT LOG
Flight No. 904

<u>TIME</u>	<u>COMMENTS</u>	<u>VALVE/BALLAST</u>
22 April 62		
0542	Take-off from Brawley (Calif.) Airport with 400 lbs. ballast. Passengers Cdr. Ben Levitt and Lt. George Lucchina	400 # Ballast
0547	Temperature 52° at 100 feet	
0551	Temperature 60° at 300 feet	5 handfulls over
0556		3 cupfulls over
0610	At 450 feet	Valve 5 seconds
0614	At 300 feet	Valve 5 seconds
0618	At 220 feet	Valve 3 seconds
0628	At 150 feet	Valve 3 seconds
0630		Drag rope out
0635		Valve 3 seconds
0637		Valve 5 seconds
0640	Landing and touch off	
0640	Touch and go landing	
0643	Touch and go landing	
0645	Touch and go landing	Drag rope(Lucchina)
0646	Touch and go landing	Drag rope(Lucchina)
0647	Touch and go landing	Drag rope (Lucchina)
0648	Touch and go landing	Drag rope (Lucchina)
0649	Touch and go landing	Drag rope (Lucchina)
0650	Touch and go landing	Drag rope (Lucchina)

<u>TIME</u>	<u>COMMENTS</u>	<u>VALVE/BALLAST</u>
0651	Touch and go landing	Drag rope, (Lucchina)
0652	Touch and go landing	Drag rope, (Lucchina)
0653	Touch and go landing	Drag rope, (Lucchina)
0654	Touch and go landing	Drag rope, (Lucchina)
0705		6 cups of ballast
0706		4 cups of ballast
0707		3 cups of ballast
0708		3 cups of ballast
0709		5 cups of ballast
0710		Valve, 6 seconds
0713	Hit power lines and worked free	
0715	Landing, intermediate - Cdr. Levitt debark, Capt. Benson aboard	
0722	Take off	
0729	Touch and go landing	
0733	Touch and go landing	
0738	Touch and go landing	
0742	Touch and go landing	
0745	Touch and go landing	
0748	Touch and go landing	
0801	Touch and go landing	
0805	Touch and go landing	
0809	Touch and go landing	

<u>TIME</u>	<u>COMMENTS</u>	<u>VALVE/BALLAST</u>
0811	Touch and go landing	
0814	Touch and go landing	
0830		6 cups ballast
0908		Valve 3 seconds
0910		Valve 3 seconds
0915		Valve 1 second
0916		Valve 2 seconds
0920	Touch and go landing	
0922	Touch and go landing	
0924	Touch and go landing	
0926		5 cups ballast
0930	Intermediate landing - Dr. Benson debarks - Cdr. Levitt aboard	
0937	Take off	
0939		Ballast - 1 bag
0940		Ballast - 1/2 bag
0941	Touch and go landing	
0945		Ballast - 1/4 bag
0945		Ballast - 1/4 bag
1004	Crossed into sand hill area	
1025	Rode thermal to 1650 feet at max. rate of ascent 250°/minute	
1115	Rode thermal to 2,000 feet - still rising	
1122	Continued to 3,000 feet	
1128	Continued to 3,900 feet	

<u>TIME</u>	<u>COMMENTS</u>	<u>VALVE/BALLAST</u>
1140		17 cups ballast
1145	Touch and go landing	
1146	Touch and go landing	
1147	Touch and go landing	
1148	Touch and go landing	
1148		Ballast - 10 cups
1149	Touch and go landing	
1149		Ballast - 10 cups
1150	Touch and go landing	
1200	Caught in "dust devil" for 5 minutes	Ballast - 1/2 bag
1214	Touch and go landing	
1215		Ballast 2/3 bag
1216	Touch and go landing	
1217	Touch and go landing	
1220	Touch and go landing	
1221	Touch and go landing	
1224		Ballast - 1-1/2 bags
1224		3 cups ballast
1225		3 cups ballast
1226		5 cups ballast
1228		3 cups ballast
1230	Touch and go landing	
1245	Landing (terminal) about 2 miles east of Holtville, California	

C. FLIGHT NO. WRI 905

Flight No. 905 was launched from the Naval Air Facility, El Centro, California at 0628 on 23 April 1962. The large Sky Car II was flown with Commander B. B. Levitt as pilot and instructor, Lt. George Lucchina as the student pilot. A 45 foot diameter balloon with a volume of 49,240 cubic feet was utilized on the flight. In addition to gaining flight time, a primary objective of the flight was to ascend to an altitude of 10,000 feet. An adverse trajectory forced termination of the flight long before the desired amount of flight time was obtained although the 10,000 foot altitude objective was accomplished. Total flight time was two hours and forty minutes.

1. Equipment Description

a. Balloon

The balloon was a 45 foot diameter balloon with an inflated volume of 49,240 cubic feet. The balloon was of double wall construction fabricated from one mil balloon quality polyethylene. It was reinforced with thirty two 500 pound test fortisan load tapes. The balloon was equipped with a 14 inch diameter manually operated apex valve. Complete specifications for the balloon, Model PA-45-100-DWSC-01 are included in the Appendix.

b. Sky Car II

The Sky Car II consists of an inner framework six feet in diameter constructed from aircraft quality steel tubing.

The outer framework, eight feet in diameter, is constructed from aluminum tubing. A styrofoam ring attached to the bottom provides the landing gear arrangement. The outer framework is enclosed with a fabric cover.

The Sky Car is equipped with four seats and seat belts.

Parachute attachment is provided by eight eye-bolts equally spaced on the upper six foot diameter steel ring of the basic frame.

Battery mounting supports are located under the floor and designed so that batteries may be dropped as ballast by firing explosive bolts.

As normal equipment, the Sky Car is equipped with a personnel oxygen system. The system is designed to have the oxygen supplied from two 25 liter liquid oxygen converters. For this flight the system was altered and gaseous oxygen was supplied from six 514 cubic inch high pressure bottles. The bottles were manifolded into two groups of three and connected to the system so that either or both groups could supply oxygen at any time. One-way check valves were installed to allow removal of depleted bottles for use as ballast without the loss of remaining oxygen. The oxygen was controlled by three pressure demand regulators to the oxygen masks. In addition to the oxygen system, the gondola was equipped with the following basic instrumentation and controls:

- (1). Aircraft Altimeter
- (2). Aircraft Rate of Climb Indicator
- (3). Cosim Variometer
- (4). Eight-day Aircraft Clock
- (5). Ambient Air Temperature Thermometer
- (6). Flight Termination Switch
- (7). Battery Drop Switches
- (8). Collins Radio Transceiver

c. Parachute and Suspension

The parachute and suspension arrangement for this flight was essentially the same as for Flight No. 904. The only difference between the two is the number of attachment points involved on the gondola, six on the small Sky Car I and eight on Sky Car II. Two parachutes were utilized for the operation, one rigged for each Sky Car.

2. Flight Operations

The flight was launched at 0628 PST on 23 April 1962 from Naval Air Facility, El Centro, California. A vertical inflation and let-up was again used. The weight breakdown of the flight is as follows:

	<u>Weight (pounds)</u>
Sky Car II	555
Batteries	318
Parachute and Harness	95
Ballast	375
Crew	400
Balloon	130
Total Airborne Weight	<u>1,873 pounds</u>

The flight was launched with approximately twenty pounds of free lift. Again, the weather was clear with negligible ground winds. The pilot was Commander B.B. Levitt, the student Lt. Lucchina. The final landing was made at 0908. Radio communications with Sky Car II were lost at 0740 and visual contact was lost due to haze at 0745. In the next few hours several reports were received concerning the flight, both of sightings and supposed landings. Lt. Cdr. Bill Arnold proceeded to the control tower at the Naval Air Facility, El Centro, California and Cdr. Sparkman went to Borrego Springs to initiate a search for the flight by light aircraft. The remainder of the ground tracking personnel were positioned near Ocotillo at this time. Mr. Winzen proceeded to check-out a reported sighting received from a gypsum mine supposedly in the area and finally located the Sky Car and crew at 1035 in the desert approximately 6 miles off Highway No. 78 near Ocotillo. All personnel and equipment were returned to El Centro.

The flight trajectory forced termination of the flight before all the objectives were accomplished. It was anticipated that Lt. Lucchina would acquire, on this flight, the required number of flight hours to qualify as a balloon pilot as well as obtain additional practice in landings. The objective of fulfilling the requirement of ascending to 10,000 feet was accomplished.

The flight log of Flight No. 905 follows.

FLIGHT LOG
Flight No. 905

<u>TIME</u>	<u>COMMENTS</u>	<u>VALVE/BALLAST</u>
23 April 1962		
0628	Takeoff from Naval Air Facility, El Centro - 330 pounds of ballast, Sky Car II Passengers Cdr. Ben Levitt and Lt. George Lucchina	
0630		Ballast 1/4 bag
0632		Ballast 10 cups
0637		Ballast 5 cups
0643		Ballast 3 cups
0646		Ballast 5 cups
0650		Ballast 5 cups
0652		Ballast 5 cups
0658		Ballast 12 cups
0700	1,000 feet Temperature 75° F	
0704		Ballast 5 cups
0706	2,000 feet Temperature 77° F	
0707		Ballast 3 cups
0714	3,000 feet Temperature 77° F	
0715		Ballast 3 cups
0716		Ballast 3 cups
0717		Ballast 5 cups
0720	4,000 feet Temperature 75° F	
0724	5,000 feet Temperature 74° F	
0728	6,000 feet Temperature 73° F	

<u>TIME</u>	<u>COMMENTS</u>	<u>VALVE/BALLAST</u>
0733	7,000 feet Temperature 71° F	
0737	8,000 feet Temperature 68° F	
0741	9,000 feet Temperature 66° F	
0748	10,000 feet Temperature 63° F	Valve 5 seconds
0754		Valve 5 seconds
0758		Valve 5 seconds
0759	9,000 feet Temperature 61° F	
0802		Valve 5 seconds
0806	8,000 feet Temperature 62° F	
0813		Valve 5 seconds
0814	7,000 feet Temperature 68° F	
0820	6,000 feet Temperature 68° F	Valve 5 seconds
0824	5,000 feet Temperature 70° F	
0828	4,000 feet Temperature 74° F	
0833		Valve 5 seconds
0834		Valve 5 seconds
0835	3,000 feet Temperature 78° F	
0838	2,000 feet Temperature 78° F	
0841	1,000 feet Temperature 80° F	
0854		Valve 3 seconds
0855	Touch and go landing	
0859		Valve 5 seconds
0908	Terminal Landing	

APPENDIX

SPECIFICATION	DATE 8/7/61	MODEL NO. PA-23-150DW-SC	SPECIFICATION NO. 01
PROJECT NO.			
NAME: BALLOON	ISSUE NO. ORIGINAL	SHEET 1 of 4	

SECTION 1.0: SCOPE

This specification covers the design, fabrication and packaging requirements of the above specified balloon model.

SECTION 2.0: APPLICABLE DOCUMENTS

2.1: WRI-100 Quality Control of Polyethylene Balloons.

SECTION 3.0: REQUIREMENTS

3.1: Performance

3.1.1: Theoretical maximum altitude with no load 62,000 (pressure altitude).

3.2: Design and Construction

3.2.1: Sphere-conical shape

3.2.1.1: Inflated volume - 6,570 cubic feet.

3.2.1.2: Inflated diameter - 23 feet.

3.2.1.3: Inflated height - 27.8 feet.

3.2.1.4: Gore length - 38.6 feet.

3.2.2: Number of gores - 10.

3.2.2.1: Double wall construction with alternate gores of red and white material.

3.2.3: Stressed tape construction.

3.2.3.1: Number of load bands - 20.

PROJECT ENGINEER <i>Robert Anderson</i>	DATE 8/7/61	DIRECTOR OF ENGINEERING <i>JR Nelson</i>	DATE 8/7/61
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SPECIFICATION		DATE 8/7/61	MODEL NO. PA-23-150DW-SC	SPECIFICATION NO. 01
PROJECT NO.				
NAME:	BALLOON	ISSUE NO. ORIGINAL		SHEET 2 of 4

- 3.2.3.2: WRI "FIST" construction - load band integral portion of heat sealed seam.
- 3.2.3.3: Load bands located at gore seams and material centerfolds.
- 3.2.4: Duct - open skirt appendix.
- 3.2.5: Inflation tube - one side inflation tube - attached 10 feet from balloon apex - 75" long x 10" layflat x .004" gauge located 180° apart.
- 3.2.6: Bubble marks - none required.
- 3.2.7: Top - WRI plate, ring and hoop with WRI Manual Apex Valve 443402.
- 3.2.7.1: Valve Line - doubled #72 braided cotton twine fastened to valve and extended through balloon with a total minimum length of 125 feet.
- 3.2.8: Base.
- 3.2.8.1: Single point suspension - consists of 2' "V" rings, attached to load tapes, to which 500# test nylon lines are attached that terminate at a parachute type "D" ring.
- 3.3: Material
- 3.3.1: Balloon film - .0015" gauge red and white polyethylene.
- 3.3.2: Load bands - 250 test laminated polyethylene reinforced fortisan filaments.

SPECIFICATION	DATE	MODEL NO.	SPECIFICATION
	8/7/61	PA-23-150DW-5C	NO. 01
PROJECT NO.			
NAME: BALLOON	ISSUE NO.	ORIGINAL	SHEET 3 of 4

3.3.3: Apex

3.3.3.1: Plate - 6061-T6 x .964 thick. Aluminum

3.3.3.2: Clamp ring - 6063-T-42. Aluminum

3.3.3.3: Hoop - 1/2" tubing - 3003-H14. Aluminum

3.3.3.4: Valve - See valve detail drawings.

3.3.4: Base fitting.

3.3.4.1: Parachute "D" ring - AN 6564.

3.3.4.2: Nylon line - 500# test braided nylon line.

3.3.4.3: "V" rings - steel.

3.4: Weight - net 40 pounds nominal.

3.5: Identification

3.5.1: The name, model number and serial number shall appear on name plate #940104.

3.5.2: The plate shall be located on the apex assembly.

SECTION 4.0: QUALITY ASSURANCE PROVISIONS

4.1: Balloon quality control procedures will be in accordance with WRL 100 Specification - Quality Control of Polyethylene Balloons.

SECTION 5.0: PREPARATION FOR DELIVERY

5.1: Reefing sleeve of 1.5 mil red poly to extend from base for distance of 25 feet. Strip of #890 filament tape to

SPECIFICATION	DATE 8/7/61	MODEL NO. PA-23-150DW-SC	SPECIFICATION NO. 01
PROJECT NO.			
NAME: BALLOON	ISSUE NO.	ORIGINAL	SHEET 4 of 4

extend for length of shroud on each side of shroud
heat seal. Entire balloon to be wrapped in single
overlay of polyethylene.

SECTION 6.0:

NOTES

6.1:

Reference Parts List for necessary production
drawings. Parts List No. 940197.

SPECIFICATION	DATE 8-7-61	MODEL NO. PA-39.34-250-NS	SPECIFICATION NO. 01
PROJECT NO.			
NAME: BALLOON	ISSUE NO. ORIGINAL	SHEET 1 of 4	

SECTION 1.0:

SCOPE

This specification covers the design, fabrication and packaging requirements of the above specified balloon model.

SECTION 2.0:

APPLICABLE DOCUMENTS

- 2.1: WR-100 Quality Control of Polyethylene Balloons.
- 2.2: Mil Specification 4640 A Dated 17 June 1957, with Amendment 1 dated 26 May 1958, Plastic Film Polyethylene for Balloon Use.

SECTION 3.0:

REQUIREMENTS

- 3.1: Performance
 - 3.1.1: Theoretical maximum altitude with no load 78,000 (Pressure altitude).
- 3.2: Design and Construction
 - 3.2.1: Natural shape design based on University of Minnesota calculations and formulae.
 - 3.2.1.1: Inflated volume - 27,000 cubic feet.
 - 3.2.1.2: Inflated diameter - 39.34 feet.
 - 3.2.1.3: Inflated height - 38.4 feet.
 - 3.2.1.4: Gore length - 59.5 feet.
 - 3.2.2: Number of gores - 14.

PROJECT ENGINEER <i>Robert E. Nelson</i>	DATE 8/31/61	DIRECTOR OF ENGINEERING <i>J. R. Nelson</i>	DATE 8/31/61
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- 3.2.3: Stressed tape construction.
- 3.2.3.1: WRI "FIST" construction - load band integral portion of heat sealed seam.
- 3.2.3.2: Number of load tapes - 28.
- 3.2.4: Duct
- 3.2.4.1: Open skirt appendix of balloon material.
- 3.2.5: Inflation tubes - two side inflation tubes - attached 20 feet from balloon apex 60" long x 10" layflat x .004".
- 3.2.6: Bubble marks - none.
- 3.2.7: Top WRI plate, ring and hoop design, with manual valve.
- 3.2.7.1: Valve line - doubled #72 braided cotton twine fastened to valve and extended through balloon with a total minimum length of 200 feet.
- 3.2.8: Base
- 3.2.8.1: Multipoint suspension - consists of 28 load tapes heat sealed to a 38" inside diameter hoop, having 12 AN quality 2-1/4" parachute V rings equally spaced, from which the parachute, having a 30" inside diameter hoop with 12 AN quality 2-1/4" parachute V rings equally spaced is supported with 3,000 pound braided nylon

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strung between V rings of balloon and parachute. 24 numbered snaps on the nylon line are provided for quick attachment to the V rings for field installation.

- 3.2.8.2: Single point suspension consists of twenty four 1500 pound nylon lines attached to the 38" diameter rings and terminating at doubled 4" AN quality steel rings.
- 3.3: Material
- 3.3.1: Balloon film - .0025" gauge of DE-2500-A.
- 3.3.2: Load bands - 500# test laminated polyethylene reinforced.
- 3.3.3: Apex - aluminum.
- 3.3.3.1: Plate - 6061-T6 x .064 thick.
- 3.3.3.2: Clamp ring - 6063-T42.
- 3.3.3.3: Hoop - 1/2" tubing - 3003-H14.
- 3.3.3.4: Valve - see detail drawings.
- 3.3.4: Base Fitting.
- 3.3.4.1: Hoop - one inch outside diameter x .054 wall steel aircraft tubing.
- 3.3.4.2: V rings - AN quality 2-1/4" parachute "V" rings.
- 3.3.4.3: Nylon line - 1500 pound braided nylon line.
- 3.3.4.4: 4" rings - AN quality steel ring.
- 3.3: Weight - Net 75 pounds nominal.

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3.5: Identification

3.5.1: The name, model number and serial number shall appear on name plate #940104.

3.5.2: The plate shall be located on the apex assembly.

SECTION 4.0: QUALITY ASSURANCE PROVISIONS

4.1: Balloon quality control procedures will be in accordance with WRI 100 Specification - Quality Control, Polyethylene Balloons.

SECTION 5.0: PREPARATION FOR DELIVERY

5.1: Packaging and marking identification will be in accordance with applicable commercial standards. Balloon to be contained in reefing sleeve extending from base to inflation tube attachment. A continuous strip of filament tape will run on both sides of reefing sleeve heat seal. Entire balloon to be wrapped in single overlay of polyethylene.

SECTION 6.0: NOTES

6.1: Reference Parts List for necessary production drawings.

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SPECIFICATION	DATE 4-3-62	MODEL NO. PA-45-100 DWSC	SPECIFICATION No. 01
NAME: BALLOON	ISSUE NO. ORIGINAL		SHEET 1 of 5

SECTION 1.0: SCOPE

This specification covers the design, fabrication and packaging requirements of the above specified balloon model.

SECTION 2.0: APPLICABLE DOCUMENTS

- 2.1: WRI 100 Quality Control - polyethylene balloons.
- 2.2: Mil Specification 4640-A dated 17 June 1957, with Amendment I dated 26 May 1958, Plastic Film, Polyethylene, For Balloon Use.

SECTION 3.0: REQUIREMENTS

- 3.1: Functional
- 3.1.1: Performance
- 3.1.1.1: Theoretical maximum altitude with no load, 86,000 (pressure altitude).
- 3.1.1.2: Rate of Rise
- 3.1.1.2.1: Recommended maximum - 1000 feet/min.
- 3.1.1.2.2: Will meet customer requirements as determined from balloon performance curves W-1093C and W-1094C.
- 3.2: Environmental
- 3.2.1: Performance - Will operate within range of temperatures and pressures encountered to theoretical

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altitude.

3.3: Configuration

3.3.1: Designed shape - sphere-cone

3.3.1.1: Inflated volume - 49,000 ft³

3.3.1.2: Inflated diameter - 45 feet.

3.3.1.3: Inflated height - 55 feet.

3.3.1.4: Gore length - 75.5 feet.

3.3.1.5: Number of gores - 16.

3.3.1.6: Stressed tape construction - each gore two 56"

centerfold sheets of .001" gauge balloon material.

3.3.1.6.1: WRI "FIST" construction - load band integral portion
of heat sealed seam.

3.3.1.6.2: Number of tapes - 32.

3.3.2: Duct - WRI open appendix of balloon material..

3.3.3: Inflation tube - two side tubes attached 18 feet from
balloon apex x 150' long.

3.3.4: Bubble marks - none.

3.3.5: Apex - WRI single manual apex valve and connecting
plate assembly No. 443402.

3.3.5.1: Valve line - doubled #72 braided cotton twine fastened
to valve and extended through balloon. Line must
extend a minimum of 125' below balloon base.

- 3.3.6: **Base**
- 3.3.6.1: Multipoint suspension consists of 32 load tapes heat sealed to a 38" inside diameter hoop having 12 AN quality 2 1/4" parachute V rings equally spaced, from which the parachute, having a 30" inside diameter hoop with 12 AN quality 2 1/4" parachute V rings equally spaced, is supported with 300 pound braided nylon line strung between V rings of balloon and parachute. 24 numbered snaps on the nylon line are provided for quick attachment to the V rings for field installation.
- 3.3.6.2: Single point suspension - consists of 24 1500 pound nylon lines attached to the 38" diameter ring and terminating at doubled 4" AN quality steel rings.
- 3.3.7: **Weight - 80 pounds nominal.**
- 3.3.8: **Identification.**
- 3.3.8.1: The name, model number and serial number shall appear on name plate #940104.
- 3.3.8.2: The name plate shall be located on the apex assembly.
- 3.4: **Material.**
- 3.4.1: **Balloon film .001" gauge, balloon quality film.**
- 3.4.2: **Load bands - 500 pound test laminated polyethylene reinforced with fortisan filaments.**
- 3.4.3: **Apex.**

- 3.4.3.1: Valve connector plate - 6061-T6
- 3.4.3.2: Clamp ring - 6063-T42.
- 3.4.3.3: Hoop - 1/2" tubing - 3003-H14
- 3.4.3.4: Manual valve - see detailed drawing
- 3.4.4: Multi-point suspension.
- 3.4.4.1: Hoop 1" outside diameter x .054 wall steel aircraft tubing.
- 3.4.4.2: V rings - AN quality 2 1/4" parachute "V" rings.
- 3.4.4.3: Nylon line - 1500 pound braided nylon line.
- 3.4.4.4: 4" rings - AN quality steel ring.

SECTION

4.0: QUALITY ASSURANCE PROVISIONS

- 4.1: Functional - balloon construction and quality control procedures will be in accordance with WRI 100 Specification Quality Control - Polyethylene Balloons.

SECTION

5.0: PREPARATION FOR DELIVERY

- 5.1: Functional - packaging and marking identification will be in accordance with WRI 200. See Note 7.2

SECTION

6.0: DOCUMENTATION

None required.

SECTION

7.0: NOTES:

- 7.1: Reference Parts List for necessary production drawings. Drawing No. 940118.
- 7.2: Reefing sleeve of 1.5 mil red poly to extend from

balloon base to inflation tube attachment location,
Strip of #890 filament tape to extend for length of
shroud on each side of shroud heat seal. Entire
balloon to be wrapped in single overlay of polyethylene.